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two or more must necessarily operate, is not at all an easy problem. Of some the effect seemed to be direct; of others it was exceedingly complex, and it would be quite easy to quarrel with the analysis in some cases. With many species it became possible to produce the sex organs or the zoospores at will; and in some species even to produce male or female organs in predominance by furnishing appropriate conditions. The volume is a monument of painstaking experimentation, and, even though elaborate, by no means represents the amount of energy which has been expended upon the problems.

We are promised the second part "somewhat later." It is to contain a general discussion of the physiology of reproduction, based upon the researches here set forth and upon the scattered statements to be found in literature. It will be welcome, and we sincerely hope that it may be doubly welcome because supplied with an index of its own, and also one for this volume which at present is wanting. It should be made a penal offense for a publisher to issue a book without a suitable index.—C. R. B.

The Laboulbeniaceæ.

WE welcome with pleasure the magnificent monograph of Dr. Thaxter[8] upon the Laboulbeniaceæ. It is not probable that any group of fungi has been honored within recent years with such thorough and detailed study as have these forms. The Laboulbeniaceæ are parasitic fungi living upon the bodies of insects, chiefly Coleoptera and Diptera.

The paper describes and illustrates with 26 plates 152 species belonging to 28 genera, and of these less than 20 species bear the names of authors other than Dr. Thaxter. He may be said to have established this group as a very important family both in respect to its systematic position and because of peculiarities of structure and sexual reproduction that make it particularly interesting.

Dr. Thaxter has adopted a system of nomenclature such that the names of the twenty-five new genera have the same endings. The results are pleasing and the continuance of the system is greatly to be desired as new genera are added.

We also express the hope that Dr. Thaxter may be allowed to describe the new forms which may be expected to be found all over the world. There is every indication that the group will prove to be a large one and only by great care will it be kept free from the mass of synonyms that overwhelms so many groups of fungi.

The Laboulbeniaceæ are very remarkable forms in many respects. They are highly specialized parasites living under peculiar conditions attached to the bodies of active insects. But they are chiefly interesting because they are ascomycetes in which sexual organs are unquestionably present in the form of trichogynes that are fertilized by antherozoids produced in curious antheridia.

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[8] THAXTER, ROLAND.—Contribution towards a monograph of the Laboulbeniaceæ Mem. Amer. Acad. Arts and Sci. **12**: 187–429. *pl. 1–26.* Dec. 1896.

The main body of the plant, termed the receptacle, is usually quite simple in structure. It consists of several cells and is attached by a disk-like base to the integument of the insect. This integument is pierced at the point of attachment, and the parasite probably draws much of its nourishment from the insect. However, there is no mycelium in the body of the host, and under the most favorable circumstances one sees only a few slight processes put forth from the basal cell of the receptacle. The hosts do not appear to be seriously affected by the presence of the parasite. On the top of the receptacle are found filamentous appendages of great importance systematically and structurally because they bear the antheridia. Lower down on the side of the receptacle is situated the procarp, a multicellular structure containing a carpogenic cell and bearing the trichogyne.

After fertilization the carpogenic cell divides several times, and from certain of the products are developed the asci. While the asci are being differentiated the sterile cells of the procarp are active in forming the wall of the perithecium. The latter is generally a flask-shaped receptacle, opening through a pore at the top, in many respects, resembling the cystocarp of certain Rhodophyceæ. The ascopores are usually discharged in pairs from the perithecium and insects are probably infected through bodily contact with one another. One usually finds the plants growing in groups close together, a habit of great importance as it makes more sure the possibility of fertilization. In certain peculiar diœcious species one of the spores of the pair is smaller than the other and develops into a small male plant at the side of the female which may be ten times as large as the former.

The antherozoids are very small bodies, frequently rod shaped, and are developed in peculiar flask shaped cells, the antheridia. The protoplasm lies in the bottom of the cell and the antherozoids are formed one after another and discharged through a constricted region into the neck of the flask. In some instances several cells discharge their antherozoids into a common cavity, and the structure is then termed a compound antheridium. Antherozoids may be observed in great numbers attached to trichogynes, but the cells are so small and the points of fusion so minute that observations upon the precise act of fertilization will be attended necessarily with the greatest difficulties.

The trichogyne may be simple or very much branched. It may be a single cell or a very elaborate multicellular structure. In its most complex form it resembles a dense bunch of delicate filaments because of the numerous forkings. The ends of the filaments may become spirally twisted.

The trichogyne is never directly attached to the carpogenic cell. In the simplest cases the two organs are separated from one another by a cell which may be called the trichophoric apparatus. When the trichogyne is multicellular the point where the antherozoid fuses may be far removed from the carpogenic cell. The form of carposporic reproduction is therefore of a type similar to that of many genera of Rhodophyceæ (Callithamnion, Spermothamnion, Griffithsia, etc.), *i. e.*, the stimulus of fertilization must be transferred through several cells before it reaches the carpogenic cell. It should be said that the cells of the trichogyne communicate with one another by strands of protoplasm, a fact also true of the cells of all other parts of these fungi and an interesting point of resemblance to the Rhodophyceæ. There is therefore open protoplasmic communication from the tips of the trichogyne to the carpogenic cell.

However, it should be noted that this fact by no means solves the problem of how fertilization is accomplished. Accepting the everywhere prevalent view that fertilization consists in the fusion of two sexual nuclei, we must imagine the nucleus of the antherozoid to pass the length of the trichogyne from cell to cell, finally fusing with the female nucleus of the carpogenic cell. Such a phenomenon, the writer believes, is entirely unknown in the plant or animal kingdom, and it is extremely difficult to conceive the mechanism by which a sex nucleus could pass through a series of nucleated cells. The high degree of specialization of the sexual organs indicates, however, that sexuality is in an advanced state of differentiation in these forms.

The discovery of such a remarkable sex process in the Laboulbeniaceæ is an important contribution to the rapidly accumulating mass of evidence proving sexuality to be present among the ascomycetes. The observations are of particular interest in connection with Stahl's discovery of a trichogyne in Collema. Nevertheless it is manifest that we are far from a solution of the problems presented by the carposporic type of reproduction in the ascomycetes, although it is equally plain that the difficulties are not to be swept aside by a denial of sexuality after the fashion of Brefeld and his followers.—B. M. D.

MINOR NOTICES.

THE EXAMINATION of a set of *Lichenes Boreali-Americani*, now having reached 140 numbers, shows that the authors, Clara E. Cummings, Thos. A. Williams, and A. B. Seymour, are distributing material of the highest quality and from widely different localities. The first set, known as *Decades of North American Lichens*, and containing 210 numbers, was begun in 1892. In 1894 the second set, known as *Lichenes Boreali-Americani*, was begun. It is to be hoped that the extensive distribution of these authentic sets will stimulate the study of a group to which too few botanists are giving serious attention. No effort to send out consecutively numbered sets has been made since Tucker-